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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/676,182	09/30/2003	Steven Verhaverbeke	AMAT/8284/CMP/W-C/RKK	6792

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EXAMINER	
CHAUDHRY, SAEED T	

ART UNIT	PAPER NUMBER
1746	

DATE MAILED: 11/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/676,182	VERHAVERBEKE, STEVEN	
	Examiner	Art Unit	
	Saeed T. Chaudhry	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-5,9-14,17-20,24-30,34-38,40,42,43 and 45 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-5,9-14,17-20,24-30,34-38,40,42,43 and 45 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's amendments and remarks filed August 31, 2006 have been acknowledged by the examiner and entered. Claims 6-8, 15, 16, 21-23, 31-33, 39, 41, and 44 have been canceled and claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45 are pending in this application for consideration. The references filed in 1449 with language different than English has not been considered because of non-English language.

Rejection under 35 U.S.C. 112, second paragraph has been withdrawn in view of amendments filed August 31, 2006.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-2, 5, 9-12, 14, 20, and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramachandran et al (WO-02/10480).

Ramachandran et al (WO-10480) disclose a method of removing residue from a substrate. The etchant solution of the instant invention would also be useful for cleaning of many types of residue material. Residue materials include, but are not limited to oxygen, silicon, carbon and elements of an underlying conductive layer (see page 3, lines 11-14).

The present invention provides an etchant composition that is capable of removing via residue and does not adversely effect the aluminum lines or lines made of other conductive materials (See page 4, lines 16-19).

The etchant composition of the present invention is an aqueous solution containing about 0.01 to about 15 percent by weight of sulfuric acid, about 0.01 to about 20 percent by weight of hydrogen peroxide, or about 1 to about 30 ppm of ozone, and about 0.1 to about 100 ppm of hydrofluoric acid (see page 4, lines 23-27).

A preferred composition of the present invention is an aqueous solution of about 8 percent by weight of sulfuric acid, and about 1.5 percent by weight of hydrogen peroxide and the remainder being substantially water, and more preferably contain about 10 ppm of a fluoride containing compound, preferably hydrofluoric acid. This composition is preferably employed at temperatures of about 35 degree C. Another more preferred composition of the present invention is an aqueous solution of about 9 percent by weight sulfuric acid and about 4 percent by weight hydrogen peroxide and the remainder being substantially water, and more preferably contain about 10 ppm of a fluoride containing compound, preferably hydrofluoric acid. This composition is preferably employed at temperatures of about 35 degree C. and is especially preferred for removing thicker and more tenacious sidewall polymer. Yet another more preferred composition of the present invention is an aqueous solution of about 5% by weight of

sulfuric acid, about 12% by weight of hydrogen peroxide and about 10 ppm hydrogen fluoride. The water employed is preferably deionized water (see page 5, lines 23 through page 6, line4).

The etchants of the present invention can be used to contact the substrate where the polymer or via residue is to be removed by any known technique, such as dipping in a bath or preferably spraying the composition on the substrate or silicon wafer having the aluminum copper lines thereon.

Typically, the composition is sprayed at a temperature of about 25 to about 95.degree. C. and preferably at a temperature of about 30 to about 50.degree. C. for about 1 to about 8 minutes, typical of which is about 2 minutes. Following this, the wafer can be subjected to a deionized water rinse followed by drying (see page 7, line 18-25). Since the rinsing step is performed after the using an aqueous solution. Therefore, the rinse solution is inherently kept separated from the aqueous solution. Further, claims 1 and 14 include a recitation "about 70% or less by weight" and "about 3° C or less", which reads as 0% percent and 0° C temperature difference. Therefore, it would have been obvious at the time applicant invented the claimed process to use cleaning composition as disclose by Ramachandran et al for removing residue from a surface of a substrate. Mixing hydrofluoric and sulfuric acid with hydrogen peroxide at different concentration before further diluting with water would have been obvious since it is known in the art to dilute the cleaning composition with water before cleaning a surface. Further the applicant has not shown any difference between composition starting with different concentration, which distinguished the claimed process from the cited art.

Claims 1-2, 5, 9-12, 14, 20, and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rath et al.

Rath et al (6,630,074) disclose a method for removing residue from a substrate. The etchant solution of the instant invention would also be useful for cleaning of many types of residue material. Residue materials include, but are not limited to oxygen, silicon, carbon and elements of an underlying conductive layer (see col. 2, lines 38-43).

The present invention provides an etchant composition that is capable of removing via residue and does not adversely effect the aluminum lines or lines made of other conductive materials (See col. 3, lines 1-4).

The etchant composition of the present invention is an aqueous solution containing about 0.01 to about 15 percent by weight of sulfuric acid, about 0.01 to about 20 percent by weight of hydrogen peroxide, or about 1 to about 30 ppm of ozone, and about 0.1 to about 100 ppm of hydrofluoric acid (see col. 3, lines 12-18).

A preferred composition of the present invention is an aqueous solution of about 8 percent by weight of sulfuric acid, and about 1.5 percent by weight of hydrogen peroxide and the remainder being substantially water, and more preferably contain about 10 ppm of a fluoride containing compound, preferably hydrofluoric acid. This composition is preferably employed at temperatures of about 35.degree. C. Another more preferred composition of the present invention is an aqueous solution of about 9 percent by weight sulfuric acid and about 4 percent by weight hydrogen peroxide and the remainder being substantially water, and more preferably contain about 10 ppm of a fluoride containing compound, preferably hydrofluoric acid. This composition is preferably employed at temperatures of about 35.degree. C. and is especially preferred

for removing thicker and more tenacious sidewall polymer. Yet another more preferred composition of the present invention is an aqueous solution of about 5% by weight of sulfuric acid, about 12% by weight of hydrogen peroxide and about 10 ppm hydrogen fluoride. The water employed is preferably deionized water (see col. 3, line 54 through col. 4, line 7).

The etchants of the present invention can be used to contact the substrate where the polymer or via residue is to be removed by any known technique, such as dipping in a bath or preferably spraying the composition on the substrate or silicon wafer having the aluminum copper lines thereon.

Typically, the composition is sprayed at a temperature of about 25 to about 95.degree. C. and preferably at a temperature of about 30 to about 50.degree. C. for about 1 to about 8 minutes, typical of which is about 2 minutes. Following this, the wafer can be subjected to a deionized water rinse followed by drying (see col. 5, lines 9-19). Since the rinsing step is performed after the using an aqueous solution. Therefore, the rinse solution is inherently kept separated from the aqueous solution.

Further, claims 1 and 14 include a recitation "about 70% or less by weight" and "about 3° C or less", which reads as 0% percent and 0° C temperature difference. Therefore, it would have been obvious at the time applicant invented the claimed process to use cleaning composition as disclose by Rath et al for removing residue from a surface of a substrate. Mixing hydrofluoric and sulfuric acid with hydrogen peroxide at different concentration before further diluting with water would have been obvious since it is known in the art to dilute the cleaning composition with water before cleaning a surface. Further the applicant has not shown any difference between

composition starting with different concentration, which distinguished the claimed process from the cited art.

Claims 1-2, 5, 9-12, 14, 20, 24-27, 38 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rath et al (EP-0918081).

Rath et al (EP-0918081) disclose a method for removing residue from a substrate. The etchant solution of the instant invention would also be useful for cleaning of many types of residue material. Residue materials include, but are not limited to oxygen, silicon, carbon and elements of an underlying conductive layer (see page 2, lines 48-50).

The present invention provides an etchant composition that is capable of removing via residue and does not adversely effect the aluminum lines or lines made of other conductive materials (See page 3, lines 6-7).

The etchant composition of the present invention is an aqueous solution containing about 0.01 to about 15 percent by weight of sulfuric acid, about 0.01 to about 20 percent by weight of hydrogen peroxide, or about 1 to about 30 ppm of ozone, and about 0.1 to about 100 ppm of hydrofluoric acid (see page 3, lines 11-13).

A preferred composition of the present invention is an aqueous solution of about 8 percent by weight of sulfuric acid, and about 1.5 percent by weight of hydrogen peroxide and the remainder being substantially water, and more preferably contain about 10 ppm of a fluoride containing compound, preferably hydrofluoric acid. This composition is preferably employed at temperatures of about 35.degree. C. Another more preferred composition of the present invention is an aqueous solution of about 9 percent by weight sulfuric acid and about 4 percent by weight hydrogen peroxide and the remainder being substantially water, and more preferably

contain about 10 ppm of a fluoride containing compound, preferably hydrofluoric acid. This composition is preferably employed at temperatures of about 35.degree. C. and is especially preferred for removing thicker and more tenacious sidewall polymer. Yet another more preferred composition of the present invention is an aqueous solution of about 5% by weight of sulfuric acid, about 12% by weight of hydrogen peroxide and about 10 ppm hydrogen fluoride. The water employed is preferably deionized water (see page 3, lines 32-42).

The etchants of the present invention can be used to contact the substrate where the polymer or via residue is to be removed by any known technique, such as dipping in a bath or preferably spraying the composition on the substrate or silicon wafer having the aluminum copper lines thereon. Typically, the composition is sprayed at a temperature of about 25 to about 95.degree. C. and preferably at a temperature of about 30 to about 50.degree. C. for about 1 to about 8 minutes, typical of which is about 2 minutes. Following this, the wafer can be subjected to a deionized water rinse followed by drying (see page 4, lines 20-25). Since the rinsing step is performed after the using an aqueous solution. Therefore, the rinse solution is inherently kept separated from the aqueous solution. Further, the cleaning solution and rinsing water are not recycled. Therefore, the solutions are inherently discarded after use.

Further, claims 1 and 14 include a recitation "about 70% or less by weight" and "about 3° C or less", which reads as 0% percent and 0° C temperature difference. Therefore, it would have been obvious at the time applicant invented the claimed process to use cleaning composition as disclose by Rath et al for removing residue from a surface of a substrate. Mixing hydrofluoric and sulfuric acid with hydrogen peroxide at different concentration before further diluting with water would have been obvious since it is known in the art to dilute the cleaning composition with

water before cleaning a surface. Further the applicant has not shown any difference between composition starting with different concentration, which distinguished the claimed process from the cited art.

Claims 1, 2, 5, 9-10, 14, 20, 24-25 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuhn-Kuhnenfeld et al.

Kuhn-Kuhnenfeld et al (4,100,014) discloses a method of removing a residue from a substrate surface with an aqueous solution. According to the invention the aqueous solution is consisting of : (A) 1 TO 30, PREFERABLY 6 - 18% BY WEIGHT, OF HYDROFLUORIC ACID; (B) 2 TO 30, PREFERABLY 6 TO 20% BY WEIGHT, OF HYDROGEN PEROXIDE; (C) 1 TO 75, PREFERABLY 20 TO 55% BY WEIGHT, OF SULFURIC ACID; AND (D) 15 TO 95, PREFERABLY 30 TO 55% BY WEIGHT, OF WATER, Wherein the quantities of the individual components are so chosen that they will add up to a total of 100%.

The simplest manner to obtain the etching solutions is by the mixing of aqueous hydrofluoric acid and aqueous H_2O_2 of commercially-obtainable concentrations, and subsequent slow stirring of concentrated aqueous sulfuric acid, that is of about 98% by weight, into the mixture (see col. 1, lines 36-53).

Another composition of etching agent, which is also very suitable, and which has the advantage compared to the above-described solution that it is stable during a period of several days, consists of one part by volume of 40% by weight of hydrofluoric acid, four parts by volume of 30% by weight of aqueous hydrogen peroxide, and one part by volume of concentrated aqueous sulfuric acid of about 98% by weight, the latter being slowly poured into the solution. Since this etching agent contains considerably less sulfuric acid, it has to be

heated first to about 80.degree.-100.degree. C, e.g., in a water bath, before being applied to gallium phosphide discs. The sawn or lapped wafer is then preferably hung in a plastic holding device in the etching solution and taken out again after five to ten minutes, rinsed with water, and dried (see col. 2, lines 21-35).

It would have been obvious at the time applicant invented the claimed process to manipulate the percentage of the hydrogen fluoride concentration of Kuhn-Kuhnenfeld et al or time for treatment and temperature for better and efficient results (see In re Aller et al., 105 USPQ 233, 42 CCPA 824). Since the rinsing step is performed after the using an aqueous solution. Therefore, the rinse solution is inherently kept separated from the aqueous solution. Further, the cleaning solution and rinsing water are not recycled. Therefore, the solutions are inherently discarded after use. Further, one of ordinary skill in the art would manipulate the percentages and temperature for mixing the solution for better and efficient results. , it would have been obvious at the time applicant invented the claimed process to use cleaning composition as disclose by Kuhn-Kuhnenfeld et al for removing residue from a surface of a substrate. Mixing hydrofluoric and sulfuric acid with hydrogen peroxide at different concentration before further diluting with water would have been obvious since it is known in the art to dilute the cleaning composition with water before cleaning a surface. Further the applicant has not shown any difference between composition starting with different concentration, which distinguished the claimed process from the cited art.

Claims 3-4, 17-19, 29-30, 34-35, 37, 40, 42-43 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rath et al or Ramachandran et al or Kuhn-Kuhnenfeld et al. in view of Gotoh et al.

Rath et al (U.S. patent 6, 630,074 or EP-0918081), Ramachandran (WO-02/10480) and Kuhn-Kuhnenfeld et al were discussed supra. However, the references fail to use surfactant in the cleaning solution.

Gotoh et al (5,650,041) disclose a method for removing residue from a substrate surface with a cleaning solution comprising hydrofluoric acid and surfactant. Wherein the surfactant is based on the glycol ether or ester and the concentration of the surfactant in the cleaning solution is 100 ppm (see col. 7, lines 7-11 and 51-57).

It would have been obvious at the time applicant invented the claimed process to incorporate a surfactant in the cleaning solution of Rath et al or Ramachandran et al or Kuhn-Kuhnenfeld et al since the surfactants are well known to reduce the surface tension and increase the wet ability of the substrate. Further, one of ordinary skill in the art would manipulate the percentages and temperature for mixing the solution for better and efficient results.

Furthermore, claim 29 include a limitation "about 70% or less by weight" and "about 3° C or less", which is read as 0% percent and 0° C temperature difference. Furthermore, producing the cleaning solution which has 1-15% hydrogen peroxide, 1-10% sulfuric acid, 10-1000 ppm hydrogen fluoride and a surfactant at 1,000 ppm is equivalent to any cleaning solution having the same percentages even though they are produced by any other processes such as mixing with different percentage products. The final product solution which is used for removing the residue would have not given any other or different results since the properties of the same percentage cleaning solution would not be changed by how the product is produced.

Claims having limitations 67% of sulfuric acid and 0.4% hydrogen peroxide and 0.1% of surfactant would have been obvious to manipulate the percentages with routine

experimentation to produce final product, which is disclosed by the cited prior art and has been used for cleaning and removing residue form the surfaces.

Claims 13, 28 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rath et al or Ramachandran et al in view of Oonishi et al.

Rath et al (U.S. patent 6, 630,074 or EP-0918081) and Ramachandran (WO-02/10480) were discussed supra. However, the references fail to use sonication.

Oonishi et al (6,273,959) disclose a method for cleaning semiconductor device by contacting the semiconductor with a cleaning solution containing 24 wt. % sulfuric acid, 5 wt % hydrogen peroxide, 0.02 wt % hydrogen fluoride, 0.075 wt % n-dodecyl-benzenesulfonic acid and water. The semiconductor is immersed into the cleaning solution for 10 minutes and thereafter semiconductor is subjected to overflow water rinsing for 7 minutes. While the semiconductor is simply immersed in the cleaning solution, other known techniques may be employed in combination with the immersion such as megasonic technique utilizing ultrasonic (see col. 4, lines 10-51 and col. 5, lines 60-65).

It would have been obvious at the time applicant invented the claimed process to incorporate the cited steps of sonication as disclosed by Oonishi et al into the process of Rath et al or Ramachandran et al or Kuhn-Kuhnenfeld et al to enhance the removal effect with the sonication.

Response to Applicant's Arguments

Applicant argued that Ramachandran et al, Rath et al and Kuhn-Kuhnenfeld et al do not teach or suggest that the cleaning solution is formed by diluting an intermediate solution nor do they

teach or suggest using a concentration of sulfuric acid of about 70% or less by weight to form an intermediate solution that then is diluted to form the etching solution describe therein.

This argument is not persuasive because Mixing hydrofluoric and sulfuric acid with hydrogen peroxide at different concentration before further diluting with water would have been obvious since it is known in the art to dilute the cleaning composition with water before cleaning a surface. Further the applicant has not shown any factual results which distinguished the claimed process from the cited art.

Applicant's arguments filed August 31, 2006 have been fully considered but they are not persuasive.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Saeed T. Chaudhry whose telephone number is (571) 272-1298. The examiner can normally be reached on Monday-Friday from 9:30 A.M. to 4:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Michael Barr, can be reached on (571)-272-1414. The fax phone number for non-final is (703)-872-9306.

When filing a FAX in Gp 1700, please indicate in the Header (upper right) "Official" for papers that are to be entered into the file, and "Unofficial" for draft documents and other communication with the PTO that are for entry into the file of the application. This will expedite processing of your papers.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (571) 272-1700.

Saeed T. Chaudhry
Patent Examiner

MICHAEL BARR
SUPERVISORY PATENT EXAMINER